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KIDNEY TUMOURS.

By

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THE object of the present paper is not to give a detailed classification of all the tumours of the kidney, such as has appeared in the fifty-ninth volume of these Reports in an exhaustive monograph by Mr. Richards,[15] but rather to dwell on certain points in the structure and the ætiology of these growths which appear to be of special interest. Not only do the kidneys form the starting point of many big neoplasms, but an examination of post-mortem material discloses a surprisingly large number of small tumours in these organs, which are generally entered in the reports as "fibromata," if, indeed, they are deemed worthy of being mentioned at all. Insignificant though they may be, it is yet by their study that we gain a not inconsiderable amount of insight into the ætiology of the large new growths, since they help to clear up many extraordinary findings, such as muscle, both plain and striated, in the "sarcomata" of infants.

Without some knowledge of the development of a part, it is impossible to arrive at a full understanding of its diseases. I propose, therefore, first to give a short account of the most recent work on the embryology of the kidney. I shall next discuss arrests of development and embryonic tumours. Then I shall deal with the small renal tumours and with carcinomata, and finally describe adrenal rests and discuss the "hypernephromata" or "suprarenal-rest tumours." Detailed descriptions will be given of such cases as may be necessary. No mention will be made of the sarcomata of adults, since there have occurred no cases of sufficient interest to deserve to be recorded.

Before proceeding further, I beg to thank the members of the Guy's Hospital staff for kindly allowing me to use their cases. A list of those authors only whose works have been quoted in the text is given at the end of this paper. For a very full bibliography the reader is referred to the fifty-ninth volume of these Reports.

DEVELOPMENT.

The kidney is developed in two parts. The ureter grows forwards from the posterior end of the Wolffian duct, which is, in part at least, derived from the epiblast. Its anterior extremity comes into close contact with a mass of mesoblastic tissue, known as the intermediate cell mass. It now breaks up into hollow branches, which end in blind dilatations or ampullæ. These ampullæ acquire a solid cap of mesoblastic cells, in which eventually a Bowman's capsule and a tubule are formed by the appearance of a lumen. These mesoblastic tubules join the ampullæ and grow in length, eventually forming the first and second convoluted tubules, the loops of Henlé, and the junctiona tubules. It appears, then, that the only part of the epitheliu of the kidney which is derived from the Wolffian duct is that o the pelves and the collecting tubules.

Bowman's capsules at first consist of a solid mass of cell projecting into a space, which is lined by a layer of cubica epithelium. Later capillaries develop within this solid mass The cubical cells of the parietal layer of Bowman's capsule soo become flattened, and later those covering the tuft of capillaries This latter event, however, does not take place until late, and th glomeruli of infants one or two months old can commonly b observed to be covered by a layer of distinctly cubical cells. O the mesoblastic part of the kidney the Bowman's capsules ar the first to become fully differentiated.

In the early embryo there is a large excess of connective tissue in the kidney, which gradually diminishes in amount, until in the adult it is reduced to a mere framework of fibrils which support the urinary tubules.

The fœtal ureter is surrounded by a thick connective-tissue envelope, which contains bundles of unstriped muscle, arranged in a concentric manner around the epithelium. This muscular layer accompanies even the collecting tubules. In the adult it is merely represented by some muscle bundles in the mucous membrane of the pelvis.

It is important to note that the capsule of the kidney also contains a fair amount of plain muscle, which may occasionally form thick bundles.

In the foregoing paragraphs the teaching of Bryce[3] and of Hertwig[10] has been followed. A very clear account of the development of the kidney has been written by Herring.[9]

DEVELOPMENTAL ERRORS, AND TUMOURS ARISING THEREFROM.

An arrest of development may take place in the kidney, which may occur over the whole of one or both organs, or may be limited to a few circumscribed areas. Either the two parts of the kidney may be formed naturally, but fail to unite, or the structures developed from the mesoblast may be imperfectly formed. In the former case the glomeruli and tubules will be fully developed, and secretion will take place; but, as the tubules end blindly, this will be retained, and produce the condition known as cystic kidney. In the latter case we expect to find either the whole or part of a kidney remaining in an undifferentiated embryonic condition. Such areas of arrested development almost invariably give rise, within the first few years of life, to a tumour formation, so that it is extremely rare to find them in an otherwise healthy kidney. This condition is, however, frequently observed in otherwise normal calves, in which animals it is said to disappear spontaneously. I have been able to find only one such case which occurred in the human subject. It was published by E. Meyer,[13] and was found in an infant with many other congenital abnormalities. There now follows a description of a similar case:—

> Alice W., æt. 10 months, was admitted under Sir E. Cooper Perry for broncho-pneumonia. At the autopsy purulent bronchitis and broncho-pneumonia were found in both lungs. The kidneys were of the size of those of an adult. Their cortex was occupied by numerous white, roughly triangular areas, the largest being a centimetre in diameter; they projected slightly above the surface. Between them the kidney was healthy, the distinction between cortex and medulla being quite conspicuous. These nodules were diagnosed as sarcoma, and the kidneys were, unfortunately, not preserved. The other organs were healthy. Under the microscope these areas present a richly cellular appearance. There are numerous masses of small round cells, with large deeply-staining nuclei and practically no cell bodies, which closely resemble lymphocytes. Gradually these cells acquire a definite cytoplasm around the nucleus, and so become larger. The nuclei also enlarge somewhat. These big cells, when fully formed, present two characteristic types, one of which consists of large cells with an abundant cytoplasm, which stains readily with eosin and resembles the epithelium of the convoluted tubules; the other, of smaller cells, whose bodies stain of a bluer tint and which resemble the epithelium of the straight tubules and loops of Henlé. Both these forms arrange themselves into solid cylinders, which gradually become more and more defined, and stand out from the surrounding tissue. A lumen next appears by the breaking down of the central cells, whose nuclei show all stages of pyknosis and disintegration. Eventually both convoluted and straight tubules are formed. The glomeruli in these areas are in a much higher stage of development, the youngest consisting of bunches of cubical and spheroidal cells, which project into a space, the Bowman's capsule. At their points of attachment these cells are continuous with, and obviously spring from, the indefinite cells which surround them. The capsules are lined by a layer of cubical or

> flattened cells. The flattening takes place very early, so that quite young Bowman's capsules may be almost entirely lined by flat cells, whereas the epithelium covering the glomeruli is still cubical in shape. Later, capillaries appear in these glomeruli and form loops within them. The connective tissue stroma consists of a few spindle cells and endothelial cells lining the capillaries.
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> The junction between these areas and the surrounding kidney substance, which is healthy, is gradual and without signs of an inflammatory reaction. None of these areas contain any traces of collecting tubules, which, of course, are of independent origin, being outgrowths of the ureter of the embryo.

Here we have an appearance closely resembling that of the developing kidney. All stages, from the earliest indifferent cells to the fully-formed glomeruli and tubules, can be made out. It will be noticed that the Bowman's capsules are more highly developed than the tubules, and that the epithelium lining their parietal layers assumes the adult flattened shape much sooner than does that covering the glomeruli. Another noticeable feature is that the youngest capsules are occupied by solid masses of cells, which at first contain no capillaries. This appearance substantiates the view now held, that the glomeruli are not formed by invaginations of capillary loops driving before them the cells of the intermediate cell-mass. Of special interest is the fact that the lumen of the tubules is formed by the breaking down and disappearance of the central cells of the cylinders, and is not due to a process of secretion. I have observed the same appearance in the kidney of a three months' fœtus.

The entire absence of any inflammatory reaction at the periphery of these nodules shows that they are not neoplasms, but an essential part of the kidney, which acts in no respect like a foreign body. It is interesting to speculate on what might have happened if this child had continued to live. It is quite possible that these areas might eventually have reached their full development. Since, however, there were no collecting tubules present within them, union of the mesoblastic and Wolffian elements could not have taken place, and at best a localised form of cystic kidney would have resulted. This absence of collecting tubules in the areas of arrested development explains the occurrence of the latter. For some reason, insufficient branches were formed at the end of the developing ureter. Some areas of the kidney were, therefore, not supplied by them, and these areas, being unable to unite with their respective non-existent collecting tubules, remained in an undifferentiated embryonic condition.

It is possible that one or more of these areas, sooner or later, would have assumed a malignant growth and have given rise to a so-called "embryonic tumour" of the kidney.

Very little connective tissue was present in these nodules. This must be taken to refer to differentiated connective tissue. The small round cells resembling lymphocytes are obviously in such an early stage of development that they may, and probably do, still retain the power of developing either into connective tissue or into epithelium.

The large size of the kidneys must not be regarded as being due to an excessive laying down of the material from which these organs were built up, but simply as a compensatory hypertrophy of the functioning parts, such as takes place when a large area of renal substance has been removed or rendered functionless. Since, from developmental considerations, it is unlikely that glomeruli can ever be formed in post-fœtal life in a compensatory hypertrophy, it can only be the tubules which grow in length and are able to branch. In such a case the glomeruli ought to be relatively diminished in numbers. I am not prepared to say, from an examination of the sections, if this is so in the present case.

This specimen represents areas of the undifferentiated mesoblastic tissue of the kidney, which for some reason have been arrested in their development, and were, at the time o death, still in a state of active growth.

This case is of great interest when we come to consider the peculiar class of tumour which occurs in the kidneys of children and is known under the names of "sarcoma of infants," "adeno sarcoma," "embryonic tumour," etc. An exhaustive paper on the subject has recently been written by Hedrén.[8]

Several such cases have occurred in Guy's Hospital. The oldest subject was a woman of forty, whose left kidney was entirely replaced by a large new growth measuring 10 by 5½ inches in diameter. The right kidney was occupied by a circular tumour measuring 6 inches in diameter, which was found to be an hypernephroma. These tumours are, however, usually found in young children, and have even been observed in the fœtus. They originate in the kidney substance, with which they are generally very loosely connected, so that they are easily shelled out from it. They are surrounded by a capsule composed of compressed and atrophied renal tissue. Two or more tumours may be present in the same kidney. Cut sections present fibrous trabeculæ, the spaces between which are filled with a soft brain-like tissue.

On microscopic examination different parts are found to vary considerably in structure. The coarser trabeculæ consist of fibrous tissue in which there often remain glomeruli and tubules, showing that some of them at least represent atrophied kidney substance. From these septa there arise delicate trabeculæ which separate the tumour into lobules. These trabeculæ are composed of spindle cells with long nuclei and a granular protoplasm, which stains readily with eosine. Some of the nuclei are very long and rod-shaped, and obviously belong to plain muscle-fibres. Only once have I been unable to find any evidence of unstriped muscle in the sections examined (Museum No. 1655 *).

The lobules between these septa consist of collections of small round cells with large, deeply-staining nuclei and very little cytoplasm. These cells grow in size, and arrange themselves into solid columns, which are converted into tubules by the appearance of a central lumen. A characteristic feature of these tumours is the way in which these tubules grow out from the surrounding mass of cells. At first they appear to be merely

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* The numbers refer to the third edition of the Guy's Hospital Museum Catalogue, London, 1899.

condensed areas of cells, which shade off into the surrounding tissue. Later they stand out more clearly; the cells composing them become cubical or columnar, and rest on a well-marked basement membrane. These tubules show a marked tendency to branch.

Other areas consist of well-developed tubules, with but a few masses of undifferentiated small round cells. They are surrounded by myxomatous connective tissue, composed of spindle, branching, and stellate cells, and are parts of the growth which have reached a higher stage of development.

I have observed collections of round cells lying within a space, and closely resembling glomeruli in an early stage of development. In the specimens preserved at Guy's Hospital these appearances are, however, rare, and have to be carefully searched for.

Some cases occur in which the tubular formations are very scanty. These specimens, at first sight, would be called pure round-celled sarcomata. Tubules can, however, in every case be found if sufficient sections be carefully examined.

Metastases most frequently occur in the lungs and the liver. Histologically they resemble the primary growth. Before discussing the ætiology of these tumours, it will be necessary to give a short account of the one already mentioned, which occurred in the left kidney of a woman of forty:—

> The connective tissue contains many unstriped muscle-cells. Masses of undifferentiated small round cells occupy the meshes of the trabeculæ. At their periphery these cells grow in size by the accumulation of cytoplasm around their nuclei. Connective tissue appears between them, and they arrange themselves in the form of solid cylinders which acquire a lumen. Irregular greatly convoluted tubules are thus formed, which grow for a long distance into the thick connective tissue septa which divide the lobules.
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> When there is a large blood-vessel these cylinders and tubules radiate outwards from it in a remarkable manner. This is due to the fact that the connective tissue septa are arranged radially, like the spokes of a wheel. When

the epithelial cylinders are solid, an appearance closely resembling the suprarenal is produced. This resemblance becomes most marked under the capsule of the tumour. Here the alveoli are much compressed, and many of the epithelial cells have become vacuolated and partially disintegrated from pressure. The resemblance to suprarenal tissue here is very striking, and is rendered all the more so by the fact that the connective tissue is practically limited to a network of capillaries, which lie between the acini of epithelium. If this tissue is traced into the deeper parts of the growth, when the pressure and consequent degeneration are less marked, the gradual change from this suprarenal-like structure to that of the bulk of the new growth can be easily made out. This appearance is of great importance, and will be referred to again under the heading of the hypernephromata.

Various views as to the origin of these tumours have been entertained. By some, who neglected the tubules, they were regarded as sarcomata, by others as remains of the Wolffian body. When we remember the characteristic appearances of tubules growing out from the masses of undifferentiated cells, the resemblance of these growths to the developing kidney becomes obvious. In the youngest parts we have numerous small round cells, from which rudimentary glomeruli and tubules are being formed, an appearance closely resembling the growing subcapsular ortion of the developing kidney. In the more advanced areas we get well-developed tubules surrounded by myxomatous "embryonic" connective tissue, such as is seen in the deeper parts f a kidney of, for instance, a six months' fœtus. It is, therefore, uite unnecessary to call to our aid remains of the Wolffian body. hese tumours should be regarded as being developed from the idney itself. Wolffian remains have, to the best of my knowedge, never as yet been found in the kidney. These neoplasms re sometimes multiple, and may show slight differences, such s a higher development of the tubules, a greater amount of plain uscle, etc. If we regard them as being derived from remains f the Wolffian body, we must assume the presence of several such remains in different stages of preservation. It seems far more reasonable to conclude that such tumours have originated in areas of undifferentiated kidney substance, which are known to occur. All their histological characters can be accounted for on such an hypothesis. The cause, whatever it may be, which, at an early period of development, produces the arrest of one area of the kidney is likely to persist, and to cause the arrest of other areas at the same or a subsequent period. In support of this view Hedrén mentions that he has occasionally found around the new growth a zone of undifferentiated renal tissue which had not participated in the tumour formation. In such a case the growth merges gradually into the kidney substance, and cannot be easily shelled out from it.

With regard to the presence of plain muscle, it must be remembered that the kidney during fœtal life is very rich in this tissue. In the adult it persists both in the capsule and in the wall of the pelvis. Since the whole of the kidney, with the exception of the pelvis and collecting tubules, is mesoblastic in origin, this muscle must come from the same cells, which also form the renal epithelium. Areas in which development has been arrested at an early period will contain the mother-cells of the epithelium and of the plain muscle.

Occasionally other structures, such as striated muscle, cartilage, bone (Hedrén), stratified and ciliated epithelium are observed in the embryonic tumours of infants. One such case has occurred in Guy's Hospital (Museum No. 1660). Here stratified epithelium, striated muscle, and cartilage are to be found :—

> This tumour was removed by Mr. Jacobson from a girl of 14, who died four months later from recurrences. The kidney is replaced by a soft, spongy new growth, except above where there is some renal substance still preserved. The pelvis is invaded by a large mass of the growth. Towards its upper pole this tumour presents, at its outer surface, a harder, well-defined area, which on section shows a fibrous appearance.
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> Under the microscope this case is an embryonic tumour. The greater part of the sections is composed of masses of

round cells, which group themselves into cylinders and tubules in the characteristic manner. The most highly-developed tubules possess a cylindrical epithelium and a definite basement membrane. Among the masses of undifferentiated cells there occur numerous collections of squamous epithelium, the cells of which have undergone a horny change and stain a blue colour by Gram's method. Some of these squamous areas are well defined and stand out from the surrounding tissues. Others are intimately blended with the surrounding small round cells or rudimentary cylinders and tubules, so that it is often difficult to be certain when these cells change into the squamous type. It is obvious, however, that we are dealing with a conversion of the embryonic cells into squamous epithelium, and that the latter is not of independent origin. The connective tissue septa are composed mainly of unstriped muscle, whose cells penetrate between the epithelial masses. Numerous striated cells occur among them. These may be round and contain an oval nucleus; or long, with several nuclei which occur in small groups of two or three and occupy a central position, producing a localised bulging of the cytoplasm. Striation is usually obscure, but all these cells stain very deeply with eosin. This striped muscle is most abundant and highly developed in the hard area of the tumour, but its cells occur even in the centres of the epithelial masses. Transitional stages between the striated and plain muscle have not been observed to occur. The cartilage is of the hyaline type and occurs as isolated nodules, surrounded by a definite perichondrium, or as quite unencapsuled groups of cells which blend with the surrounding connective tissue, and between which a hyaline matrix appears.

In this case we are dealing with an embryonic tumour of the kidney, in which, in addition to the usual tissues, there are present squamous epithelium, striated muscle, and cartilage. From an examination of the sections it is, I think, obvious that this is a neoplasm which has started in kidney tissue, and not an embryoma, which has become associated with an embryonic renal tumour. Such an embryoma would represent an included twin or a cell which had become separated off at an early stage of embryonic life, before the primary germinal layers had become established, and had, after a period of quiescence, assumed active malignant growth. Such a cell would be able to form epi-, meso-, and hypoblastic tissues, and we could thus explain the presence of squamous epithelium, etc., in this tumour. We should then, however, expect to find that the growth of the squamous epithelium was independent, and not intimately associated with the rudimentary kidney tubules, as is actually the case in the specimen under discussion; for it seems very unlikely that the greater part of such an embryoma would possess the structure of a renal tumour, which is the same as saying that its greater part was composed of kidney tissue. I believe this tumour is analogous to cases of squamous epithelioma occasionally found in the intestine, gall-bladder, pancreas, etc., and that the presence in it of horny cells must be explained as a case of metaplasia, *i.e.*, the assumption by the cells derived from one germinal layer (*i.e.*, the mesoblast) of morphological characters belonging to the cells of another layer (the epiblast). Embryologists have laid far too much stress on the immutability of the germinal layers--that a cell destined to form a part of, for instance, the small intestine, can never come to resemble a cell of the epithelium covering the surface of the body. The truth seems rather to be that the differentiation of the germinal layers is a functional one--that a cell going to form part of the epithelium of the small intestine becomes columnar solely for the reason that this is the most useful shape that it can assume,--but that, if this cell should for some reason be displaced outward on to the surface of the embryo, it will develop into a tough horny cell. Therefore, in certain pathological conditions, the cells of one layer are able to assume the characters of those of another layer, from causes that we do not as yet understand properly, but which may be allied to long-continued irritation. These causes seem occasionally to be in force in tumours such as the present one, and they ought to give us pause and to show us that we cannot expect to arrive at the truth by the study of merely one class of phenomena, such as those of embryology, but that even pathological conditions may occasionally throw an important light on the problems of development.

Since a tumour which, in its greater part, possesses the structure of an embryonic kidney tumour, has been shown to contain squamous epithelium, one might be tempted to argue that this class of new growth does not really originate in the kidney, but is some kind of embryoma. The close similarity to the developing kidney, however, precludes this view from being accepted, since all stages, from undifferentiated round cells to well-developed renal tubules, can be made out.

CYSTIC KIDNEYS.

Practically everything that has been said of the ætiology of the embryonic tumours may be repeated of cystic kidneys. The former represent areas of arrested development which have undergone a tumour formation, the latter are similar areas which have undergone the greatest degree of physiological differentiation possible under the circumstances.

Cystic kidneys are often congenital, and are found with decreasing frequency as life advances. The condition is not infrequently bilateral, and may vary from a mass of cysts, which are separated only by thin bands of functioning kidney substance, to a few cysts in an otherwise healthy organ. The latter form is seen not uncommonly at post-mortems. The surface of the kidneys is smooth, and scattered over it there are a varying number of cysts, from one or two to several dozens. These cysts usually occupy the cortex, but are sometimes present in the pyramids as well. A very good example occurred last year in a child two years old (1908, No. 248). Only one kidney was affected ; it contained several collections of small cortical cysts. I have examined sections of several such cases, and have been unable to find any evidences of chronic interstitial nephritis, such as would cause blocking of tubules with subsequent dilatation by the accumulation of secretion.

The cysts often contain the remains of a glomerulus. Others are surrounded by bands of plain muscle. The epithelium is flattened, cubical, or columnar. Diverticula grow out from the tubules. These may branch and extend for some distance into the connective tissue.

All these cysts end blindly. The condition is due to a failure of union of the mesoblastic and Wolffian elements of the kidney. Development and function, however, go on, producing dilatation of the blind tubules with the formation of cysts.

SMALL TUMOURS OF THE PYRAMIDS.

The conditions hitherto described can all be shown to be due to an arrest of development of the kidney. These undifferentiated areas may persist more or less unaltered, may attain full development and differentiation, but fail to unite with their appropriate Wolffian tubules, or, lastly, may give rise to true neoplasms with metastases.

There is, however, yet another tumour of the kidney, which can be explained on the same lines. On systematically examining the kidneys at post-mortems, in about 5 to 8 per cent. rounded or oval white nodules are found in the pyramids. They are well-defined, fairly hard, and stand out above the neighbouring tissue. In size they vary from a speck just recognisable with the naked eye to nearly a centimetre in diameter. Two such nodules may occur in the same pyramid. The largest number I have counted in one kidney was seven. They occur at any age, but, owing to their generally minute size in infants, and to the fact that they grow with the kidney, they are usually only obvious in adults. It is often necessary to cut up the whole kidney into thin strips, 4 to 5 mm. in thickness, in order to make certain of not missing them. Busse[4] describes an analogous case in a boy one year old, who had deformed hands. He has often found these tumours to contain plain muscle and epithelial tubules. Nürnberg[14] was unable to find muscle in them, and thinks that some are tumours arising in an area of maldevelopment, whereas others are due to atrophic changes and sclerosis of the connective tissue. Some of the nodules I have examined are undoubtedly due to the latter cause. They occur in kidneys which are undergoing a granular change, and are merely localized patches of sclerosis, and not neoplasms.

The majority are, however, neoplasms. They can usually be shown to consist of two areas: a central one, in which the connective tissue is arranged in whorls, such as are seen in fibromata, and a peripheral zone, composed of sclerotic kidney substance. The central area contains a few tubules lined by a columnar epithelium and possessing a definite basement membrane, around which there is usually a ring of condensed fibrous tissue. Extensive necrotic changes can often be observed, most marked in these rings around the tubules. There are other epithelial elements to be seen, namely, columns and tubules, which extend from periphery to centre in a radial manner. Their nuclei are large and stain deeply, and their cytoplasm is scanty. I believe that they are newly-formed tubules, which grow into these areas from the surrounding tissue.

The peripheral zone consists of sclerotic fibrous tissue, and contains the remains of atrophied renal tubules, which have been pushed aside by the tumour. The central area is occasionally made up of myxomatous tissue with long spindle-shaped and branching cells. In such a case the periphery does not show this structure, but consists of ordinary fibrous tissue.

Only once have I been able to find plain muscle in one of these nodules. It was represented by thin bands and isolated cells, with definitely rod-shaped elongated nuclei and a granular protoplasm.

It is, I think, certain that we are here dealing with a tumour formation. The arrangement of the fibrous tissue, the sharp contour of these nodules, and the way in which the surrounding renal tubules are pushed aside, all substantiate this view. I have been able to confirm Busse's finding of plain muscle, and agree with his view that the tumour has arisen in fœtal remains. It will be remembered that, during early embryonic life, the collecting tubules, derived from the Wolffian duct, are surrounded by unstriped muscle, which disappears as development proceeds. This disappearance may, in some cases, be incomplete, so that small rudiments of muscle may occasionally remain in the pyramids, which at a late period acquire active independent growth and give rise to small myomata. As life proceeds, the connective tissue surrounding the muscle grows at the expense of the latter, so that by the time the tumour has reached any size it has entirely replaced it. An indication of such a replacement is afforded by the rings of condensed connective tissue around the epithelial tubules, which are the remains of the collecting tubule whose development has been arrested. The occasional myxomatous condition of the central areas may be due to œdema. If this were so, we should expect the sclerotic peripheral zone occasionally to participate in this change. It may, I think, with fairness, be explained as an embryonic condition, the tumour possessing the form of embryonic connective tissue, such as is seen in the kidney of the six months' fœtus.

The greatest argument against these nodules being embryonic tumours is their absence, or great rarity, in infants. Here, however, they may be so small and undeveloped that they are invisible to the naked eye, and only found with the microscope by the merest chance. It would be necessary to cut serial sections of many infants' kidneys to arrive at a definite knowledge of their presence or absence.

CORTICAL FIBRO-MYOMATA.

It will be well to consider the cortical fibro-myomata in this place. They are small, white, roughly triangular nodules, which project above the surface of the kidney, and are always torn on stripping the capsule. This is owing to the fact that they are attached to the latter, and indeed originate within it. They are the hardest kind of tumour that occurs in this situation, and this character, together with their torn surface, is their best macroscopic distinguishing feature. They are often multiple. Microscopically, they contain bundles of plain muscle, arranged in an interlacing manner; these bundles are separated from each other by a varying amount of fibrous tissue. The tumours are quite unencapsuled, and may extend into the surrounding kidney for a considerable distance. In their deeper parts they often contain the remains of glomeruli and renal tubules. There are never such remains on or under their free surface, an indication that they are derived from the capsule. The capsule extends over them, and they become blended with its substance. The largest fibro-myoma I have seen was ½ cm. in diameter. Busse[5] describes two large ones, one of which contained striped muscle.

It has already been stated that the kidney capsule contains muscular tissue, which may occur as thick bands. These tumours are to be regarded as fibro-myomata arising in connection with this muscle.

Occasionally these nodules are composed of spindle and round cells, when they closely resemble a sarcoma. I have seen a case which consisted partly of this tissue and partly of adult plain muscle. Such tumours may occasionally form the starting-point of large sarcomata. Bland Sutton[2] says that sarcoma of the kidney in adults arises under the capsule. Lipomata are common in and under the capsule. In the latter case they may extend into the kidney substance.

ADENOMATA.

The next class of tumour to be considered is the so-called adenoma of granular kidneys. These tumours are exceedingly common, but, owing to their minute size, are often overlooked and only found accidentally in microscopic sections. Adenomata, large enough to be seen with the naked eye, occur in about 5 per cent. of all granular kidneys. They are rounded nodules, which may occur in any part of the cortex. Usually, however, they are placed superficially, and then project slightly above the surface of the kidney. They are of a white or yellowish colour, and may be 1 cm. or more in diameter. At times they are definitely unencapsuled, at others they shade off gradually into he surrounding renal substance. They may develop in a scar on he surface. I have seen three such tumours, lying side by side, n such a scar. Occasionally the whole of a kidney may be tudded with these nodules. Such a case occurred at post-mortems some time ago. The affected kidney was small and ranular. Its surface and cortex were studded with numerous white nodules, varying in size from 1 cm. downwards, which were all adenomata.

When an adenoma develops in one of those depressed granular areas, so common in chronic nephritis, it lies below the surface; otherwise it always projects above it.

Under the microscope the commonest form of adenoma is seen to consist of a cyst-like space, usually surrounded by a wall of coarse fibrous tissue, which shades off gradually into the neighbouring kidney substance. The space is lined by a single layer of cubical or columnar epithelium, which is often flattened from pressure, and, in the larger tumours, may entirely disappear. From the wall trabeculæ project into the lumen of the space, which are composed of a small amount of delicate connective tissue, and contain a central thin-walled blood vessel. These trabeculæ branch in an irregular manner, but, if outline drawings of serial sections going through the whole of a tumour be made, it will be seen that these septa are not true papillæ with a blind ending, but always join the cyst wall again; so that, however much this growth may resemble a papilloma, it really consists of dilated, very irregular tubules. This only applies to the primary septa, from which short true papillæ are often given off, which may branch a little, but usually end very soon. The trabeculæ are covered by a single layer of epithelium which, when well developed, consists of very tall columnar cells with round darkly staining nuclei, and a cytoplasm which stains intensely with eosin. The nuclei show a tendency to lie near the free and not the attached extremity of the cells. The cytoplasm is often granular and extensively vacuolated. Degeneration into a shreddy, colloid mass and hæmorrhages are frequent. Solid papillæ, composed only of epithelium, are often observed. Tubular processes grow down into the fibrous capsule and into the thicker trabeculæ.

When small, these tumours may be quite unencapsuled. They then resemble dilated renal tubules from which short papillæ project. This epithelium is taller and stains more deeply than does that of the surrounding kidney tubules, and the connective tissue in the septa is always present, and is an important distinguishing feature. The surrounding renal tubules are slightly compressed. Only once have I been able to show a communication between the lumen of an adenoma and a kidney tubule, in a case presently to be described.

Another class of adenoma possesses an obviously tubular structure. There are trabeculæ composed of a delicate young connective tissue, covered by a layer of cubical epithelium, which is far shorter and stains much bluer than that of the forms just described. These growths are unencapsuled, and extend between the tubules of the kidney, from which they can easily be distinguished by their darker staining.

Nùrnberg was unable to show their connection with the surrounding renal tubules. I have been able to demonstrate this connection once only, in the case of an entirely unencapsuled tumour of this kind. Here, in several sections of a series, the dark tumour cells are seen side by side in the same tubules with the lightly staining renal epithelium. As far as I am aware, this is the first time that such an appearance has been observed. Usually, even when there is no connective tissue around the tumour, its tubules can, in serial sections, be shown to end blindly between those of the kidney. Where a capsule is present, this appearance becomes more marked, and the tubules of the new growth can be traced for some distance into the surrounding tissues. On the whole, these tumours show but few signs of active growth. Retrogressive changes can often be seen in them, and they seem to have a low vitality, and probably often disappear spontaneously.

We have, then, a form resembling a papilloma, but really composed of highly convoluted and intercommunicating tubules, in which the epithelium assumes a tall columnar shape, and in its staining powers closely resembles that of the convoluted tubules of the kidney. We also have a tubular form with cubical epithelium which presents no marked characters, being composed of small cubical cells; this form has been shown to communicate with a renal tubule. A still earlier form can occasionally be seen. This consists of a dilated kidney tubule, whose epithelium has become very tall. This tubule is highly convoluted, and the bends between the convolutions resemble papillæ. The epithelium also tends to grow into the lumen in solid clumps. Such dilated tubules are occasionally found in the fibrous areas of granular kidneys, and may communicate with a convoluted tubule, whose epithelium may be extensively degenerated. I believe this appearance to be the first step towards the production of an adenoma. It is obviously a condition of hyperplasia, possibly with the object of making up for lost epithelium, but can hardly be considered to be a neoplasm. Later this hyperplasia increases, the tubule affected becomes more and more convoluted, though still communicating with the tubules above and below it, its cells assume an independent growth, and form processes which grow out into the surrounding tissue. The borderland between hyperplasia and true tumour formation is thus reached. If the growth of the cells goes on, the surrounding tissue becomes compressed and destroyed, and the tubules grow out in an independent manner; an adenoma is thus produced. That this independent growth may proceed until it assumes a malignant type with the production of metastases is shown by the way in which the epithelium occasionally grows deep down between the neighbouring renal tubules, or far into the capsule; also by the structure of many carcinomata of the kidney. This malignant growth is, however, not often reached. From a consideration of the appearance of these adenomata, which only rarely show signs of rapid growth, and which usually contain evidence of degenerative changes, it appears very probable that the majority of them disappear again. Occasionally one sees cysts in granular kidneys which contain traces of septa, and are filled with epithelial débris. These are, I think, the remains of degenerated adenomata.

It is important to note that this form of new growth is practically never seen except in granular kidneys, and becomes progressively commoner with advancing age. A few cases have been recorded in otherwise healthy kidneys; *e.g.*, by Manasse.[12] This almost constant association with granular changes in the kidney is a strong point in favour of these tumours being caused by hyperplastic changes in the renal tubules, with the object of compensating for lost epithelium. Such regeneration can be observed occasionally in granular kidneys, and occurs both in the convoluted and straight tubules. A twisted mass of epithelium, whose nuclei stain deeply, and whose cell-bodies are small, is seen occupying a space which is the remains of a straight tubule. Stœrck,[17] has recently investigated these changes very fully, and has shown that regeneration of epithelium in chronic nephritis is of frequent occurrence.

GLOMERULAR TUMOURS.

The tumours so far considered have all originated in the epithelium of the secreting tubules of the kidney. There are, however, a few cases on record in which their starting-point has been the glomeruli. Abram,[1] Hildebrand,[11] and Sharkey,[16] have published such cases. In Abram's case the parietal layer of Bowman's capsules was lined by several layers of columnar epithelium, which infiltrated the surrounding connective tissue. The epithelium over the vascular tufts was normal. There were metastases on the ribs, sternum, vertebræ, pleuræ, lungs and liver. The case of Sharkey is very similar, but may possibly be a squamous epithelioma arising in an ovarian dermoid, with an ndependent new growth of the glomeruli. Abram's case appears o be a primary carcinoma of the glomeruli.

The following is a description of a kidney tumour, which may have started in a glomerulus :—

> Insp. 1902, 508. Museum 02^{54}.—William S., æt. 68. Fibroid, hypertrophied, and dilated heart, atheroma of aorta and pulmonary vessels. Lungs emphysematous, congested and œdematous. Kidneys.—Weight 421 grm. Normal in appearance. Projecting from the external border of the left kidney, exactly half-way between the two poles, there is an oval yellowish tumour 3·8 by 2·5 cm. in diameter. It is separated from the kidney by a deep sulcus, and presents a slightly irregular surface. The cut surface of the tumour consists of several lobules, separated from each other by connective tissue septa. It extends for about 1·5 cm. into the substance of the kidney, and is limited

below by a pyramid. It is surrounded by a fibrous capsule. The whole of this tumour, therefore, lies within the cortex; ½ c.m. below it there is a large multilocular cortical cyst. No other tumour was found at the autopsy.

Microscopic appearance :—

a. Of the kidney.—The blood-vessels are thickened. Under the capsule there are several patches of interstitial sclerosis, the fibrous tissue being old, and containing but few nuclei. The glomeruli are, on the whole, healthy. The vascular tufts are large, and the capillary loops well marked. Bowman's capsules often show a varying amount of thickening and increase of fibrous tissue, which may have proceeded to complete fibrosis and occlusion of the glomerulus. There is quite a large number of such fibrous glomeruli. A very noticeable feature in them is that a hyaline degeneration has occurred in these fibrous glomeruli, but nowhere else.

b. Of the tumour.—The capsule consists of atrophied and fibrosed kidney substance, from which large connective tissue septa project into the interior of the tumour, many of which contain thin-walled blood-vessels. From these septa there radiates in all directions a very irregular network of trabeculæ, most of which are coarse. Some are, however, very fine. All these trabeculæ are occupied by capillaries of varying sizes, so that the connective tissue is generally reduced merely to a ring around them. The most striking feature is that the whole of the connective tissue within the tumour has undergone a hyaline degeneration. This is very well shown in sections stained with v. Gieson. The walls of the capillaries within the trabeculæ are lined by a layer of flattened or slightly cubical endothelial cells. The spaces between the trabeculæ are, however, lined by large cubical endothelial cells, which have often proliferated so as completely to fill up the spaces, or have invaded the surrounding connective tissue, thus producing large nodules. Typically the inter-trabecular spaces do not contain blood, but there are several large areas of necrosis and of hæmorrhage where the structure of this tumour is very much obscured. The resemblance of certain areas to the vascular tuft of a glomerulus is striking.

Here we are dealing with an angeioma or angeio-endothelioma, and not with an adenoma. I have, however, described this specimen here, since I believe it to be a tumour which has started in a glomerulus. It may, in a sense, be called an adenoma of a glomerulus. The irregular spaces, lined by cubical endothelial cells and containing no blood resemble the cavity of Bowman's capsule, whereas the trabeculæ with their numerous dilated capillaries resemble the glomerular tuft. In support of this view it may be noted that, whereas the whole of the connective tissue of the tumour had undergone hyaline degeneration, the only parts of the kidney to do so were the glomeruli.*

CARCINOMA.

There are two possible sites of origin of carcinoma of the kidney: the secreting tissue, and the pelvis and calyces. Indeed, both these parts form the site of origin of malignant new growths, which can be distinguished from each other both by the naked eye and with the microscope. It will be well to study these two classes separately.

The tumours originating in the kidney substance present two forms, the diffuse and the nodular. The diffuse variety invades the kidney in all directions and eventually replaces its entire substance. It usually starts in the depths of the organ, since, with the microscope, the remains of renal tissue can often be made out at the periphery. This form may be soft and brainlike in consistency, or hard and fibrous. I believe, however, that some, at least, of such tumours arise in the pelvis; these specimens will be described later.

The nodular form always originates on the surface of the kidney. It is usually separated from the renal tissue by a definite capsule (cf. Mr. Targett[19]), but may nevertheless reach as far as the pelvis, which it may even invade and break through, and grow for some distance along the ureter. As this form of tumour possesses a structure somewhat resembling that of the suprarenal, I will leave its microscopical description until discussing the hypernephromata.

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* Since writing this, Dr. Kettle, of the Cancer Hospital, has shown me a very similar tumour, which was removed at operation. The main distinction s that in this case extensive hæmorrhage had taken place, and the large ndothelial cells were stained brown with the altered blood which they had aken up.

Although the diffuse form originates in the depths of the kidney, the pelvis seems to offer a great resistance to being invaded by it. As the kidney becomes affected its tubules are occluded, and no urine can escape from these damaged tubules. This explains the rarity of hæmaturia in this condition. A great part of one kidney may be destroyed by carcinoma, and yet the urine be healthy.

As regards the microscopic appearance of renal carcinoma, it is composed of cubical and spheroidal cells, which tend to grow in large masses, with no very characteristic features. Occasionally, however, appearances can be observed which show that some of these tumours, at least, have originated in an adenoma. In the museum there is preserved a very good specimen in point :—

> No. 1645. A right kidney, removed from a woman æt. 26, which is extensively infiltrated by new growth, presenting a somewhat nodular appearance. The growth had invaded the renal vein and caused pulmonary embolism. Metastases in lungs, liver, and lumbar lymph-glands. Microscopically this tumour is a spheroidal-celled carcinoma. It extends into the kidney substance in the form of nodules, which are usually partially surrounded by a fibrous wall, from which there project in several places delicate connective tissue trabeculæ, containing a central capillary and lined by a tall columnar epithelium. These trabeculæ join each other, and enclose between them small spaces, into which more delicate secondary trabeculæ project. These parts of the tumour are identical with what has been described above in connection with adenomata.

There can, therefore, be no doubt that adenomata of the kidney may sometimes assume a malignant growth and give rise to metastases.

Other carcinomata possess a tubular structure. They contain small alveoli lined by cubical and columnar cells, and bounded by a small amount of connective tissue, which is often merely represented by the endothelial walls of capillaries. If the epithelial cells possess a homogeneous deeply-staining cytoplasm, these tumours are usually called columnar-celled carcinomata; if, however, the cells are extensively vacuolated, they are classed among the hypernephromata, a point which will be referred to fully later.

Renal tumours show a marked tendency to break through into the circulation. Not only is the renal vein often occluded by a malignant thrombus, as in a case recorded by Fagge,[6] but emboli of new growth may be discovered in the blood-vessels of the lungs.

> Insp. 1909–35.—A lobulated tumour at the lower pole of the right kidney, metastases in the liver and lungs. Projecting from the wall of a large pulmonary vessel, and firmly adherent to it, there was an embolus, ½ cm. in diameter, consisting of new growth, which is invading the intima of the vessel and becoming vascularised from it. Many of the small pulmonary metastases occupy the lumina of blood-vessels.

CARCINOMA OF THE RENAL PELVIS.

The tumours starting in the pelvis are usually associated with conditions of chronic irritation, such as stones. They may occur as papillary tufts projecting from the dilated calyces and pelvis, or uniformly infiltrate and enlarge the kidney, so that this organ is converted into a large solid mass of new growth in which branching calculi may be embedded. Occasionally such a tumour may closely resemble the nodular variety of carcinoma which starts in the kidney proper. Such a case occurred last year:—

> Insp. 1908, 214.—The kidney is enlarged to twice its normal size. The middle three-quarters are occupied by a partially encapsuled, rounded, slightly lobulated tumour with many yellow areas of necrosis and of hæmorrhage. This tumour has extensively implicated the pelvis, and projects into it in the form of necrotic granulations. Above

> this area the pelvis is free from new growth, but it is dilated and thickened. Two renal papillæ project into this part. The kidney substance is reduced to a strip above and below the tumour; the latter of these contains two, apparently isolated, nodules of growth. Metastases in lungs and liver.

The foregoing description would apply very well to a nodular carcinoma of the kidney or hypernephroma. The microscopic appearance was obscured by the large amount of necrosis and vacuolation of the cells. It was not until two similar tumours which are preserved in the Museum were examined that a correct diagnosis as to its nature could be arrived at. I will first describe these specimens and then their histology.

> Museum, 1648. "A kidney, enlarged so as to measure seven inches in length, and uniformly infiltrated by a soft new growth which projects into the dilated pelvis of the organ and blocks the renal vein. The upper end of the ureter is distended for a distance of about 2 inches by a mass of growth continuous with that in the pelvis."

This description might again apply to a hypernephroma, from which it is impossible to distinguish this specimen. The following tumour, however, which presents the same microscopic appearance, conclusively proves the site of origin.

> Museum, 1654. "A right kidney, at the inner margin of which is situated an oval tumour measuring three and a half inches in its longest diameter. It is closely applied to the hilum of the kidney, but is not connected with this organ, which has been laterally compressed, and moulded to the convexity of the tumour. Anteriorly the growth is nodular, some of the nodules projecting into the dilated renal vein. On the back the surface is rough, and was firmly adherent. The cut section shows the growth to be composed of homogeneous material, traversed by coarse strands of translucent fibrous tissue."

Here, then, is a tumour which has started in the pelvis at some little distance from the kidney, which organ it had not invaded. A metastasis was found in an aortic lymphatic gland. I may add that there is nothing in the naked-eye or microscopic appearance of this tumour to suggest that it might have originated in a displaced piece of renal tissue.

The microscopic appearance of these three specimens is very similar. The growth consists of a framework of connective tissue, which is arranged in the form of delicate trabeculæ and papillæ, many of which contain a central capillary. This is covered by very large columnar and cubical epithelial cells with big, round vesicular nuclei. In parts their cytoplasm stains deeply, but generally the staining is faint, and the cells may even be vacuolated. These cells proliferate very rapidly, so that the intervening spaces become filled by large masses of large irregular cells, which may assume a columnar, cubical, or even fusiform shape, so that parts of the sections resemble at first sight a very large spindle-celled sarcoma. Many multinucleated giant cells are present, which attain their maximum size in the pulmonary metastases of the first case, where they resemble large syncytia. In these metastases I have observed appearances strongly suggestive of commencing keratinization, but have been unable to stain them satisfactorily by Gram's method, possibly owing to the fact that the tissues had been fixed in formalin. Hyaline degeneration was well marked in the walls of the arteries of cases 1 and 3.

The large size of these cells and their clear vesicular nuclei resemble transitional epithelium somewhat closely. Since, in the first case, the alveoli are usually small and filled with cells which are so extensively degenerated that it was almost impossible to find more than an isolated healthy cell, and the connective tissue happens to be somewhat cellular, we at first called this tumour a hypernephroma. This opinion was strengthened by the xamination of the naked-eye specimen. It was not until this ase was compared with the other two that its true nature was rrived at.

Carcinoma of the renal pelvis may sometimes be a typical quamous-celled epithelioma with prickle-cells, keratinization, nd horny cell nests. Museum specimen 99[52] is such a case. Here the dead horny cells are extensively calcified. Such pitheliomata or cancroids, as they have been called, occasionally appear in mucous membranes lined by other than squamous epithelium. It is not difficult to explain their presence in the renal pelvis, since this organ is formed from an outgrowth of the Wolffian duct, which is now considered to be derived, in part at least, from the epiblast. This layer almost always gives rise to squamous epitheliomata, and it is therefore not surprising if the epithelium of the renal pelvis, its descendant, occasionally does so likewise.

SUPRARENAL TISSUE IN THE KIDNEY.

Suprarenal tissue is often found in the kidney. One or both suprarenals may be displaced and lie within or under the kidney capsule. They will then not be found in their normal position.

More frequently, however, these organs occupy their normal site, but in addition to them accessory suprarenal tissue is found in or under the kidney capsule. These accessory adrenals are usually very small, yellow, flattened areas, which lie on the surface of the kidney and project but slightly, if at all, above it. Occasionally they may attain a considerable size, as in Insp. 1908—609, in which a piece of suprarenal, 1½ cm. in length, was applied to the upper pole of each kidney. In the case of the left organ it sent a long tongue-like projection deep down into the renal cortex. Both suprarenals were present in their normal position.

Accessory suprarenals are frequently observed in other places. Mr. Targett[19] has seen them in the broad ligament of the fœtal uterus. I have found them on the under-surface of the liver and in the spermatic cord.

Under the microscope these nodules nearly always consist of suprarenal cortex, the cells of which are arranged in the manner characteristic of this organ, and may possess a healthy uniformly staining, or a highly vacuolated cytoplasm. They are usually only partially encapsuled, so that the suprarenal tissue often extends for some distance between the kidney tubules. Large specimens may contain medulla as well, as in Insp. 1908—609, in which the tongue-like process was totally unencapsuled, and to contain within it pieces of renal substance, which it had enclosed during its growth.

A very noticeable feature of these accessory suprarenals is their benign appearance. There are usually no signs of active proliferation, and their epithelium seems to grow slowly between the renal tubules, which eventually atrophy. There are no signs of malignant growth and of destruction of kidney substance.

HYPERNEPHROMA.

Ever since Gravitz's[7] classical paper in 1883, in which he propounded the theory that hypernephromata of the kidney arise in aberrant suprarenal tissue, this explanation has been accepted by all pathologists. Sudeck[18] was, for a long time, the only one to oppose this view. His papers were, however, ignored. The only warning against accepting Gravitz's views too blindly, that I can find in the English language, is in a paper by Mr. Targett,[19] in 1896, in which he states that he has only found one such tumour in five years, of which he was convinced that it grew from a suprarenal rest. Quite recently Stœrck[17] has written an exhaustive paper, in which, after due consideration of the chemical and anatomical features of these tumours, he comes to the conclusion that they are formed not from suprarenal inclusions, but from the renal tubules themselves.

Before committing oneself one way or the other, it will be well to review the main anatomical and histological features of the hypernephromata.

They are nodular tumours which occupy, when small, the superficial cortical part of the kidney. They are more or less rounded encapsuled new-growths, consisting of lobules of a soft parenchyma separated by fibrous trabeculæ. Their most characteristic feature is their yellow colour, which is often rendered darker by hæmorrhage. They show a marked tendency to grow through the substance of the kidney into the pelvis, which they often break through, thus giving rise to profuse hæmaturia.

An hypernephroma may occupy either pole or the middle of the kidney. The remaining kidney substance is then pushed aside by it.

Metastases occur frequently by the blood-stream.

The smallest hypernephroma we have observed at post-mortems (1907—341) was an irregular encapsuled nodule, 1 by ½ cm. in diameter, which lay in the most superficial part of the cortex, near the upper pole of the kidney, and projected considerably above its surface.

Microscopic examination reveals an appearance which, at first sight, strongly resembles the tissue of the suprarenal cortex. These are rounded solid acini of epithelial cells, whose protoplasm is extensively vacuolated, and often reduced to a ring around the cell and a few thin threads traversing its substance. These acini are separated from each other by thin-walled capillaries, whose spindle-shaped nuclei often form their only covering. The acini may grow so as to form large masses of cells which are closely packed together and contain no true central lumen, any existing cavitation being obviously due to central necrosis. In the larger acini giant cells are said to be of frequent occurrence. In our specimens, however, they were, on the whole, rare. The only case which showed them well was Mr. Golding-Bird's case, figured in the 59th volume of these Reports. These, then, are the characteristic microscopic features of these tumours; features that induced Gravitz, and most writers after him, to believe that they represent new growths arising in aberrant suprarenal tissue.

If, now, sections taken from many parts of as many of these tumours as possible be examined, remarkable appearances will often be encountered. The connective tissue often proliferates and occludes the capillaries, so that the acini over large areas are separated by definite and even stout connective tissue septa. The epithelium is by no means always vacuolated, but in many parts consists of large homogeneously staining cells, which bear not the faintest resemblance to the epithelium of the suprarenal. This feature is well illustrated in Mr. Golding-Bird's case just mentioned. Again, the smaller acini often consist of spaces lined by a layer of cubical or columnar cells whose free ends project in a clubbed manner into the central lumen. This lumen is not caused by the disappearance of central cells, and may even be occupied by a colloid material, identical in appearance and in staining reactions with the secretion so often found in the kidney tubules. I have observed this appearance in the centre of the large hypernephroma of the right kidney of a woman of forty, whose left organ contained the embryonic tumour already described. Here it could not possibly have been produced by the inclusion of renal tubules, since the tumour was totally encapsuled and showed no signs of malignant or even active growth. Not only do the acini often enclose a lumen, but the epithelium may grow into this lumen in the shape of papillæ, which often contain a delicate connective tissue core, surrounding a central capillary. When, as often is the case, the cells lining these papillæ are tall and columnar, the resemblance to an adenoma of the kidney is very striking.

The most complete case, however, was one of Dr. Hale White's, which has already been described and figured,* and which, therefore, need not be described at length here. A typical hypernephroma was removed by operation. A large local recurrence occurred, which presented a marked papillary structure, consisting of thin-walled blood-vessels surrounded by a small amount of connective tissue, and covered by many layers of columnar and cubical epithelium. The drawings of this case bring out the differences between the original tumour and the recurrence very plainly. Here there could not be the slightest doubt that the growth had originated in the kidney substance itself.

Not only do these hypernephromata show such appearances, but occasionally a tumour, which no one would call a hypernephroma, presents areas which closely resemble suprarenal issue. Such an appearance has even been observed in the mbryonic tumour of the left kidney of a woman of 40, which has been described above. It is possible that the tumour of the ight kidney of this case may have been of a similar nature.

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*Journal of Pathology and Bacteriology, 1909.

Such papillary appearances strongly suggest that the tumours in which they occur are formed from the kidney substance itself, and not from aberrant suprarenal tissue. The suprarenal is a solid body with no external secretion, whereas the kidney consists of a mass of tubules which are often, in pathological conditions, distended by retained secretion. The kidney frequently gives rise to adenomata, which show a marked papillary arrangement. Although I believe most of these papillæ to be false, yet true papillæ occur. As stated above, the epithelium of real adenomata is occasionally extensively vacuolated.

It would take too long to review Stœrck's researches on the nature of the substance occupying these vacuoles. He comes to the conclusion that in hypernephromata they are caused almost entirely by hydropic distension, since a very pale tumour of this nature may contain little or no fat.

Primary carcinomata of the suprarenal are rare. I have had the opportunity of examining but one case, which was a spheroidal-celled carcinoma, and in no way resembled a hypernephroma of the kidney.

On taking all these facts into consideration, it seems to me that many, at least, of the so-called "hypernephromata" of the kidney are really renal and not suprarenal tumours. Fascinating though the theory may be that in the kidney, where displaced suprarenal tissue is so common, this tissue gives rise frequently to tumour formation in the sense of Cohnheim's theory, yet it will be well for these tumours to be carefully examined and their varying microscopic appearance to be taken into account before we too blindly accept their origin from displaced suprarenal rests.

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